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# The Influence of Pension Funds on Corporate Governance<sup>†</sup>

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## Abstract

Although pension funds have gained importance in the last two decades, their role has not been described in detail by economic models. This paper focusses on the scope of these institutional investors when they are not satisfied with a management team of a company in which the pension fund holds a block of shares. Stock holdings by pension funds are largely dispersed. Therefore, any intervention by pension funds in corporate governance requires the formation of a coalition of pension funds. The realization of a coordinated intervention, in turn, is subject to the problems related to the provision of public goods, such as free-riding. We find that the stock dispersion and the combined share of pension funds, coordination costs and the attractiveness of the exit option are relevant factors for determining the probability of the success of interventions.

*Keywords: Pension Funds, Corporate Governance, Public Goods, Coase Theorem*

*JEL classification: G23, G34, H41, Q50*

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# 1 Introduction

In this paper, we investigate under which conditions a group of homogeneous pension funds has a chance at forming a coalition to exert pressure on the incumbent management team.<sup>1</sup> These huge pension funds hold widely diversified portfolios and can never act as raiders for fiduciary reasons. Their position in a single firm, albeit big from the point of view of a small shareholder, is nevertheless usually too small to pursue costly monitoring and intervening singlehandedly. Therefore, monitoring and intervention can only be undertaken by forming a coalition with other pension funds. Coalitions of pension funds need ex ante a low cost-benefit ratio in order to have a chance to be successful. Our one-period model of forming the coalition is similar to Palfrey and Rosenthal (1984) or Dixit and Olson (2000), but in contrast to these authors we do not assume fixed or even declining contribution costs per participant, but rather rising contribution costs. This reduces the probability of a successful coalition outcome, but describes costs of coalition procedures more precisely. Additionally, we formalise the alternative option each pension fund has of unloading part or all of its stockholding if it is not content with a particular firm. Whether that option is economically feasible mainly depends upon transaction costs and the rate of reinvestment return. The defense of shareholders' interests against dysfunctional behaviour of managers has always been at the core of corporate governance theory. In contrast to the vast literature on raiders and other blockholders, as far as we know the role of pension funds has not been investigated in theoretical models yet. One reason could be that pension funds invest in a very diversified manner and therefore very seldom appear in the public or media. Pension funds cannot act as raiders, taking over firms, both for legal reasons and because such an action does not fall within their purpose. Another reason is that, because of diversification, even a sizeable pension fund holds only a minor stake of a few percent in any one specific firm. CalPERS for example, the large and active California public pension fund, holds about 1400 different stocks

and owns “between 0.5 and 2 percent of the outstanding stock for each company in its portfolio” (Hawley and Williams, 2000) which is already at that time far above the average size of stock holdings of pension funds. Risk considerations lead such huge pension funds to be prone to liquid stocks, which usually also induces them to undertake only small or no monitoring efforts at all. If a stock position seems doubtful, an individual pension fund therefore can sell its stake rather than undertake the costly efforts of monitoring and intervening. But selling a stake of the size of 0.5 to 2 percent will most likely have a negative impact on the stock price. This argument applies even more if all pensions funds want to sell the same stock at the same time.<sup>2</sup> This individualistic behaviour has to be viewed differently if we consider that nowadays pension funds as a group own a sizeable portion of the stock market. In 2012 pension funds in OECD countries held USD 21.8 trillion in assets. This compares to USD 30.0 trillion from investment funds, USD 24.5 trillion of assets from insurance companies and USD 1.9 trillion from other institutional investors. Pension funds in OECD countries therefore have a market share of 28% of total assets managed by institutional investors (OECD 2013). Most of the assets of pension funds are concentrated in a few countries. USD 11.6 trillion (or 53.4% of all pension fund assets) are held by pension funds domiciled in the United States, followed by pension funds in the United Kingdom with assets worth USD 2.3 trillion (11%), Japan with USD 1.4 trillion (6.6%), the Australia with USD 1.4 trillion (6.5%), the Netherlands with USD 1.3 trillion (5.8%), Canada with USD 1.2 trillion (5.5%) and Switzerland with USD 0.7 trillion (3.4%).<sup>3</sup> If some or all pension funds wanted to unload a displeasing stock position at the same time, the induced price drop affects not only the selling funds - through both in sold and unsold stocks - but also all other inactive pension funds. This potential for pension funds has been recognised especially in the USA. Hawley and Williams pointed out that institutional investors, whom they name “universal owners” (since they own all stocks), could potentially play a prominent role with regard to corporate governance

questions. If pension funds choose voice instead of exit it depends on their size and capability to pose a credible threat on the management's reputation in the public. Giant pension funds such as the California Public Employee Retirement System (CalPERS)<sup>4</sup> or the Teachers Insurance and Annuity Association-College Retirement Equities Fund (TIAA-CREF) have enough assets under management to undertake costly monitoring of companies by themselves, without incurring too high costs, which would deteriorate the ratio of total operating costs.<sup>5</sup> CalPERS and TIAA-CREF not only do proxy voting by themselves but also undertake corporate engagement privately with portfolio companies, when they perceive shortcomings in their governance. On the other side of the spectrum are small and medium sized pension funds, for which monitoring of companies is both too costly and too time-consuming. Corporate governance became an economic and political issue for bigger public or private pension funds in the 80s and 90s of the last century. In order to confine costs within reasonable limits, bigger pension funds started alone or in small groups to monitor companies and shared the analysis with other pension funds, which participated in the accruing costs. Prime examples for this historical process of coalition building of pension funds are Hermes and Ethos.

The market for corporate control, in turn, may be subject to inefficiencies (Grossman and Hart, 1980), since raids are costly and atomistic investors will free-ride on the actions of the raider, i.e. not tender the shares, in order to enjoy the improvement in the firm.<sup>6</sup> As Olson showed in 1965, the free-rider problem becomes more severe, the higher the number of private parties necessary for the production of the public good. And the bigger the free-rider problem, the less likely it is that the public good will be produced by private parties, which have to voluntarily form a coalition. Palfrey and Rosenthal in 1984 first presented a formal model for calculating the probability of the production of the public good. Dixit and Olson in 2000 use a similar model, but they assume that total contribution costs are fixed, whereas Palfrey and Rosenthal assume

that the contribution of each participant is constant, independent of the number of cooperative parties. In our paper we also use the Palfrey and Rosenthal approach, but we assume that total contribution costs rise with the number of participants. The assumption of rising costs in our model is very plausible, since coordination of opinions and actions is more complex and costly the higher the number of parties involved and the less informed potential participants of a coalition are.

The paper is organized as follows: in the next section, we summarize and discuss briefly related empirical findings. In Section 3, we examine under which circumstances a coordinated effort of pension funds has a chance of being successful. It will be shown that the formation of a winning coalition will be more likely when pension funds have a higher concentration of stocks of the targeted company. In the fourth section we investigate the case of pension funds using the “exit” option by selling the specific stock. Depending upon the size of the “market impact”, e.g. the price decline of the sold stock, the financial result of both courses of action can be compared. In Section 5 we conclude and discuss the results of the preceding two sections in the context of current thinking on corporate governance issues and propose further research opportunities. In the concluding section we show possible implications for pension funds and policy makers.

## **2 Empirical findings**

Critical views claim that pension funds would not be specifically qualified to take on the role of monitoring firms operating in different industrial environments, and therefore should concentrate only on their role as fiduciaries for their clientele of active contributors and retirees. In an early empirical paper, Smith (1996) investigated the approach and success of CalPERS (California Public Employees Retirement System), the largest public pension fund in the United States and

very prominent due to its monitoring of companies. Empirically, Smith found mixed results; stocks of firms that agreed to changes proposed by CalPERS had an abnormal positive return of +1 percent, while stocks of resisting firms had an average negative return of -1 percent. But operating profits of targeted firms did not improve after intervention by CalPERS. Activism for the portfolio of CalPERS though showed positive results. After reviewing a wide set of empirical studies with regard to the effectiveness of pension funds' monitoring, Prevost and Rao (2000) conclude that results are mixed. No positive effect could be proven for both the operating performance and the stock performance of targeted firms. Prevost and Rao test the hypothesis that the primary function of a proposal of a pension fund is to act as a signaling mechanism in alerting the market that the targeted management is unwilling to negotiate a settlement with the pension fund. Prevost and Rao find in their event study that firms experienced negative wealth effects when targeted either by CalPERS, or by a coalition of public funds supporting one or more proposals on the same proxy. Firms which were targeted several times by public pension funds experienced permanent declines in market value. Some empirical studies focus not on performance data of shares of targeted firms, but on direct effects of monitoring. Faccio and Lasfer (2000) analyse the monitoring role of occupational pension funds in the UK, and conclude that these funds are not effective monitors. Del Guercio and Hawkins (1999) study shareholder proposals of the largest, most active funds in the USA up to 1993 and find that shareholder proposals are followed by significant corporate governance activity and wide corporate changes such as asset sales and restructurings. Crespi and Renneboog (2010) investigate voting coalitions which aim at disciplining incumbent management. They find that Shapley values capturing the relative power of shareholder coalitions outperform models with percentage ownership stakes. Other authors such as Barber (2007) point out that an additional conflict of interest could arise when pension funds engage in institutional activism.<sup>7</sup> In our setting we only investigate the case

of shareholder activism, which covers situations where pension fund managers want to increase shareholder value of firms or to impede at least a decline. The model we present below relates to the latter while the former can be considered as a symmetric case. It is known since decades that the increase of disperse and the decline of active ownership can create problems not only for concerned (specific) firms but for the market system as a whole. This problem is closely connected with the amount of monitoring and coordinating costs and therefore is directly tied to different compulsory settings, which strongly influence these costs. In 1992 the U.S. Securities and Exchange Commission (SEC) relaxed the conditions under which shareholders could communicate during a proxy contest. This reform lowered communications costs and thereby encouraged shareholder coordination. Choi (2000) finds that nontraditional sponsors such as unions or religious organizations increasingly acted as a sponsor of proxy issue proposals thereby undertaking "social activism" in Barber's (2007) terms. But Choi (2000) also found that companies with a high stockholding of managers or other insiders were also more often targeted.

Overall Choi (2000) finds that legal barriers to shareholder communications should undergo further liberalization. Many empirical studies have shown that "the main activist tool, Rule 14a-8 shareholder proxy proposals is weak and ineffective in eliciting change and improving performance of target firms" (Del Guercio et al. 2008), mainly due to high monitoring and coordinating costs. In order to reduce the cost problem, Grundfest already in 1993 advocated so called "just vote no" campaigns. Here active investors do not target specific proxy issues but suggest that they and other shareholders withhold votes in board elections in order to express their dissatisfaction with operating performance or corporate governance issues. Del Guercio et.al., examining 112 "just vote no" campaigns from 1990 to 2003, find compelling evidence, that this low-cost tool is an effective device to bring the board of directors to undertake measures such as firing a weak CEO in order to improve operating performance. If "just vote no" campaigns are started for corporate



governance reasons, the outcome is less clear, i.e. they find not significant changes in operating performance.

The discussion of both methods - "just vote no" or proxy issue campaigns - clearly shows that the institutional framework determines to a large degree the amount of the incurred monitoring and coordinating costs of possible active pensions funds and thereby heavily influences not only the probability that such interventions are undertaken but also their success rate. Additionally, corporate governance will be improved on average by the pure threat, since board of directors as well as managers know, that possible intervention of active investors is more likely to be successful.

### **3 Model for coalition building - voice only**

Due to portfolio considerations, stock holdings by pension funds are largely dispersed. Therefore, it cannot be expected that many interventions by pension funds in corporate governance will be accomplishable without the pension funds forming a coalition. As we will argue below, the realisation of a coordinated intervention is subject to several characteristics strongly linked to the problems known from public good provision such as free-riding. Essentially, free-riding may result in a failure of the Coase Theorem as participation in the coalition is voluntary. This is precisely the reason that pension funds may not engage in shareholder activism even though such action may result in a pareto-superior outcome. Coase argued that given a government that allocates property rights between parties and a court that enforces the agreed bargain, a precise allocation of property rights and the absence of any costs of information or negotiation would lead to a bargaining solution between two parties that internalizes any externalities between them. Moreover, Coase extended this argument to larger groups so that in his idealised world of zero transaction costs, efficient outcomes can be achieved no matter how large the groups

are. According to Dixit and Olson (2000), Coase did not claim that he was offering a theorem, contrary to the economic literature based on Stigler (1971) who asserted that he did. A typical formulation of the Coase Theorem states that in the absence of transaction costs, rational parties will necessarily achieve a Pareto-efficient allocation through voluntary transactions or bargaining. In reality however, transaction costs do matter and must be taken into account in defining a Pareto-efficient outcome. Dixit and Olson (2000) further argue that if the Coase Theorem applies, it must also be true that rational parties will conduct all those trades in private goods - and all those bargainings which internalize externalities or provide public goods - that yield positive net gains greater than the transaction costs of realising them. Consequently, the Coase Theorem under transaction costs implies a marginal condition according to which rational parties will necessarily achieve a Pareto-efficient allocation through voluntary transactions or bargaining.

Olson (1965,1996) and Dixit and Olson (2000) among others have argued that the Coase Theorem would lead in many cases to absurd conclusions as it does not take into account the number of parties who must participate in the internalization of externalities or the provision of public goods. The result of Pareto-inefficient outcomes is therefore not only due to transaction costs which would be covered by the modified Coase Theorem, but also to the existence of free-rider incentives. The latter in turn are a function of population size,  $N$ , and the minimum number of parties,  $M$ , necessary to produce a public good. We follow this line of argument based on Dixit and Olson (2000) that the Coasian claim that a 'meeting' of all beneficiaries of the public good will achieve unanimous agreement on the provision of that public good neglects the non-cooperative incentive to free-ride on the coalition's effort. As stated above, it is an inherent part of the Coase Theorem that participation and agreements are voluntary. Only focussing on the 'meeting' therefore overstates the power of the Coase Theorem and leads to an overoptimistic view of the efficiency of market outcomes.

We assume that the provision of a public good - the increase in the economic performance of the firm under consideration - requires a minimum number of pension funds  $M$  bearing its production costs, with  $M < N$ . Everyone is free either to join the coalition of size  $M$  or to free-ride. If there is a sufficient number of pension funds joining the coalition, so that the public good can be produced, intervention takes place. Hence, each agent - each pension fund in our case - has to formulate the probability of his participation in the coalition being pivotal or not. Obviously, the probability of being pivotal depends on  $M$  relative to  $N$ . If  $N$  is large compared to  $M$  the probability that one pension fund is pivotal is small, hence, each pension fund may decide in a non-cooperative manner not to join the coalition and to free-ride. This in turn means that intervention cannot take place because of the wide dispersion of stocks in the respective enterprise that are held by pension funds.

In the setting we present here, each pension fund is free to join the coalition or not. Additionally, as far as the distribution of shares of the firm under consideration is concerned, we assume an equal distribution of shares held by pension funds ( $i = 1, \dots, N$ ), with  $\alpha^{PF} = \sum_{i=1}^N \alpha_i < 1$  representing the overall amount of shares held by the  $N$  pension funds.<sup>8</sup> The remaining shares  $1 - \alpha^{PF}$  are held by other market participants, institutional and private investors. Moreover, we assume that the economic performance of the firm under consideration is reflected by shareholder value. Normalizing the market value of a firm to one, and assuming that the economic performance of the firm remains at its current level with a successful intervention and is zero otherwise, the benefit of a member of the coalition,  $\Pi_1$ , is equal to the weight of shares held by all members joining coalition. The assumption of normalizing the market value to one and to zero if the coalition fails to form serves as a theoretical point of reference and will be relaxed further below. If the number of pension funds within the coalition reaches the critical level  $M$ , the intervention is successful, the costs  $C$  of the intervention are shared within the coalition and the expected

increase in the economic performance of the firm exhibits the characteristics of a non-excludable public good. Although each pension fund is free in its decision to free-ride or to join the coalition, it is known to everybody that there is no increase in shareholder value if the coalition fails to form. Hence, the decision to free-ride is dependent upon the probability of success that the coalition will form without the participation of the pension fund willing to free-ride. Therefore, in order to decide whether to join the coalition or not, each pension fund has to formulate a rational expectation of whether the coalition will be successful without its participation. There are only two possible outcomes: success or failure. We denote by  $P$  (which is endogenous) the probability of any pension fund  $i \in N$  joining the coalition. At this point, we can denote the probability of exactly  $M$  successes in  $N$  independent Bernoulli trials, where the probability of success in each trial reads

$$b(N|M, P) = \frac{N!}{M!(N-M)!} P^M (1-P)^{N-M}. \quad (1)$$

From the perspective of an individual pension fund, the rational decision can be demonstrated as follows. If there are  $(M-1)$  or more players out of  $(N-1)$  players, then the expected net benefit of joining the coalition (IN) from the perspective of the  $(N-1)$ -th player amounts to

$$\sum_{n=M}^N \frac{(N-1)!}{(n-1)!((N-1)-(n-1))!} P^{n-1} (1-P)^{(N-1)-(n-1)} \left[ \Pi_1 - \frac{C}{n} \right]. \quad (2)$$

On the other hand, if more than  $M$  of  $N-1$  players choose IN, the  $(N-1)$ -th player could choose OUT and free ride on the coalitions effort earning an expected benefit of

$$\sum_{n=M}^{N-1} \frac{(N-1)!}{n!(N-1-n)!} P^n (1-P)^{N-1-n} \Pi_1. \quad (3)$$

A mixed-strategy equilibrium requires indifference between joining the coalition and free-riding hence equalizing the last two expressions yields

$$\begin{aligned}
& \underbrace{\frac{(N-1)!}{(M-1)!((N-1)-(M-1))!} P^{M-1} (1-P)^{(N-1)-(M-1)} [\Pi_1]}_{\text{benefit of choosing IN}} \\
& = \underbrace{\sum_{n=M}^N \frac{(N-1)!}{(n-1)!((N-1)-(n-1))!} P^{n-1} (1-P)^{(N-1)-(n-1)} \left[ \frac{C}{n} \right]}_{\text{cost of choosing IN}}
\end{aligned} \tag{4}$$

The term on the LHS in Eq.(4) means that  $M-1$  chose IN, hence  $N-1$  is pivotal. The RHS is the cost share of the  $(N-1)$ -th player when he chooses IN.

In aggregate  $M$  players are necessary to form a coalition.  $P$  adjusts such that any player is indifferent between joining and not joining the coalition, hence

$$\frac{\binom{N}{M} P^M (1-P)^{N-M}}{\sum_{n=M}^N \binom{N}{n} P^n (1-P)^{N-n}} = \frac{b(M|N, P)}{1 - B(M|N, P)} = \frac{C}{\Pi_1 M} \tag{5}$$

An equilibrium implies that the shared costs among coalition members in relation to the expected gain has to equal the conditional probability at the margin that the coalition forms. Moreover, the cost-benefit ratio on the right-hand side must be smaller than one ( $\Pi_1 > \frac{C}{M}$ ), to make the formation of a coalition economically reasonable. Figure 1 shows the cumulative probability,  $Q$ , that a coalition of size  $M$  will form (dashed line) as a function of  $P$  for a given  $N$  which is, not surprisingly, increasing in  $P$ . The solid line shows the behavior of the left-hand side in Eq. (5) which is declining in  $P$ . Formally, the left-hand side can be interpreted as a hazard rate which answers the question of how big the variation of the probability is that there are not more than  $M$  successes in  $N$  independent Bernoulli trials, after an infinitesimally small increase in  $P$ , given

that the probability of drawing more than  $M$  is  $Q = 1 - B(M|N, P)$ . Obviously, the hazard rate is declining from 1 to 0 as  $P$  increases from 0 to 1 (for more details see appendix).

The equilibrium probability of success is determined endogenously by Eq. (5) depending on  $M$ ,  $N$ ,  $\Pi_1$  and  $C$ . Since it is not possible to solve Eq. (5) analytically, we have to apply a numerical iteration method by discretization of the probability space.<sup>9</sup>

**Figure 1 about here**

As previously mentioned, pension funds hold large dispersed stocks varying between 0.1% and 1% in one firm. Therefore, no pension fund is supposed to hold a very large position in a particular firm. Intervention costs,  $C$ , consist of two blocks: monitoring costs,  $O$ , which are assumed to be of a given size per company and include the costs of collecting information about a specific universe of companies and second, the coordination costs among the group of pension funds which choose to form a coalition,  $\varepsilon M$ , with  $\varepsilon > 0$ . Therefore,  $C$  can be written as<sup>10</sup>

$$C = O + \varepsilon M \tag{6}$$

With regard to the coordination costs, we assume quite an optimistic scenario as the linearity in  $M$  suggests the collaboration among pension funds which minimizes coordination effort.<sup>11</sup> Coordination costs will be rather high before a coalition has been formed and has successfully targeted listed companies: Pension funds have to invest heavily in monitoring and coordinating activities without being sure that they can achieve a positive effect. The hurdle of high coordinating costs can be overcome when a relatively big pension fund such as for example the pension fund of British Telecom, which founded Hermes in 1983,<sup>12</sup> starts monitoring on its own and afterwards is joined by other pension funds. Ethos was founded by a coalition of two pension funds from Geneva and quickly opened up its monitoring services to other pension funds.<sup>13</sup> When a coalition of pension funds has formed and has shown its successful presence in the field of corporate

governance, coordination costs will be lower, since a defined product can be offered.

In Table 1, we present numerical solutions for the individual probability  $P$  of joining the coalition and the cumulative probability,  $Q$ , that at least  $M$  pension funds are willing to join the coalition. Before we turn our attention to the results, we discuss the calibration of our model. The critical level of shares necessary for a successful intervention is denoted by  $\alpha_{crit}$ . Obviously  $\alpha_{crit}$  is bounded from above by 0.5. In most cases it is not necessary, however, to have a majority in order to win a proxy vote.<sup>14</sup> If the number of minority shareholders, for example noise traders is big, it may well be that an  $\alpha_{crit}$  far below 0.5 may be sufficient to win. In addition, a low  $\alpha_{crit}$  appears to be realistic, if the coalition of pension funds is able to pose a credible threat with respect to a severe damage of the firm's reputation on the management. Whether or not the management fears such an attack can depend on the individual characteristics of the coalition members and on the numbers of votes they can collect. Pension funds with a high public impact would reduce  $\alpha_{crit}$  substantially. As has been pointed out before, pension funds in OECD countries have a market share of 28% of total assets managed by institutional investors, in 2012 (Pension Markets in focus, OECD 2013). If we assume that assets are evenly divided between private and institutional investors, market share of pension funds halves to around 14%. We thus consider  $\alpha_{crit}$  to fall in between 0.1 and 0.15. As regards the individual share a pension fund holds, we fix  $\alpha_i$  indirectly by observing that the size of an effective coalition is determined by  $\alpha_i = \alpha_{crit}/M$ . Hermes and Ethos report 35 and 140 members respectively which reflects approximately a lower and an upper bound for  $M$ . For  $\alpha_{crit}$  and  $M$  given, we thus calculate a range for  $\alpha_i$  between 0.07% and 0.43%. The total number of pension funds,  $N$ , invested in the firm under consideration is 200. Ethos charges a minimum of CHF 8'000.- for proxy voting services for the 100 biggest Swiss companies. This amounts to 0.2 basis points or 0.002% of invested capital of a pension fund. Additionally, administrative support at the General Assembly costs another

0.001%, if wanted. The more labour intensive service for corporate engagement has a higher cost of 0.4 basis points or 0.004%. As previously mentioned, the OECD reports for Switzerland that total operating costs amount to 0.3% of total assets. If we assume that Swiss pension funds had invested all their assets in Swiss equities and would engage not only in proxy voting but also in corporate engagement monitoring costs amount to about 2% of total operating costs. As further reference and as an anecdotal case, the big pension fund of the City of Zurich can serve as an example: The pension fund manages about CHF 13.8 Bio, of which CHF 4.35 Bio or 31% are invested in equities. Due to its size and its efficient operation the fund has total operating costs of only 0.19% of invested assets. The pension fund obtains monitoring services both from Ethos and Hermes and discloses costs 256 000 CHF for these external services (Annual Report 2012). Internally, another 50 000 CHF accrue to labor costs. These 300 000 CHF are a little bit higher than 1% of total operating costs of 26.4 Bio CHF. Given this empirical evidence we fix  $O = 0.001$ .

As regards  $\varepsilon$ , we face the problem that this parameter is not reported by pension funds, such that we fix  $\varepsilon$  through the plausible assumption that the cost-benefit ratio of an intervention should not exceed 5.5%, if the probability of coalition formation is high. This implies that  $\varepsilon = 0.00004$ .

As can be seen in the baseline scenario (Table 1(a)) for an individual share per pension fund  $\alpha_i = 0.01\%$ , the minimum number of funds joining the coalition is 100 out of 200. An increase in the shares held by pension funds implies a lower  $M$ . A lower  $M$  in turn decreases the probability that one single pension fund is pivotal for the success of the coalition and therefore diminishes the willingness to bear the costs of the intervention. Hence, the incentive to free-ride on the coalition's effort is higher and the probability,  $P$ , for choosing to join the coalition (c.p.) lower. At the same time, intervention costs are decreasing implying a higher cost-benefit ratio of the coalition while a lower number of participants is needed to form a coalition. Both effects increase the probability of coalition formation  $Q$ .<sup>15</sup>



In Table 1(b), we analyze the effects of a higher  $\alpha_{crit}$ . Obviously, a higher  $\alpha_{crit}$  c.p. increases  $M$  which lowers the cost-benefit ratio of the intervention. Both, the increase in  $M$  and the reduction in  $\frac{C}{\Pi_1 M}$  induce a lower incentive to free-ride on the coalition's effort, hence,  $P$  and  $Q$  increase. On the one hand, a reduction in the number of shareholders who do not participate in a proxy vote increases the chances for successful coalition formation. A reduction of  $\alpha_{crit}$  due to a threat of a severe damage on the management's reputation reduces the probability of successful coalition building since the incentive to free-ride is larger.

In Table 1(c), we present the effects of a substantial increase in coordination costs compared to the baseline scenario in Table 1(a). The increase in the coordination costs leaves  $M$  unaffected. A higher cost-benefit ratio, however, reduces the incentive for each pension fund to join the coalition, hence  $P$  and  $Q$  are lower (see also Figures 2 and 3).

**Table 1 about here**

**Figure 2 about here**

**Figure 3 about here**

Coordination cost are surely an important factor influencing the probability of coalition formation but it is obviously not the only one. We thus analyze now the effect of an increase in the cost-benefit ratio through a reduction in net benefits. So far, we assumed that the value of the firm drops to zero, if the intervention fails, which is the most extreme assumption possible. In Table 1(d), we relax this assumption and consider the case in which the value of the firm drops only for 20% if the coalition fails to form. Due to the increase in the cost-benefit ratio the incentive to join the coalition is reduced and the probabilities of coalition formation are lower. If the individual share a pension fund holds is low, the probability of coalition formation may even approach zero.

Given the economic rationality of incentives to free-ride, we isolated three reasons which may be responsible for the failure of an intervention. A wide stock dispersion of pension funds reduces stock concentration in each firm which increases coordination costs since more members are necessary to form a coalition. High coordination costs lower the economic incentive to join the coalition and decrease the probability that one single pension fund is pivotal. Second, the higher the amount of other market participants, the smaller is the minimum size of the coalition, which again increases the individual incentive to free ride. Additionally, since the coalition is smaller in size, the benefit  $\Pi_1$ , which can be internalized is smaller and therefore the cost-benefit ratio deteriorates more. Finally, a cost-benefit ratio surpassing a value of 0.25 in fact raises the probability,  $P$ , for choosing to join the coalition, but nevertheless the probability of coalition formation,  $Q$ , drastically diminishes to 6%. Since monitoring costs are generally fixed, intervention costs could only be reduced by economizing on coordination costs, for example in a more efficient institutional setting such as delegated votes.

## 4 Exit option

Pension funds, which do not participate in the coordinated effort to improve a specific firm have two possible choices: They can hold on to the shares of the specific firm and thereby hope to free-ride on the actions of the coordinating pension funds, or they can sell their shares in that specific firm in order to reinvest the proceeds in the stock market. Because of the equilibrium condition between participation in the coordinated effort and free riding, these two possibilities yield ex ante the same return. This outcome has to be compared with the situation where a specific pension fund uses an exit strategy and sells part or all of its stock position,  $\alpha_i$ . We assume that the pension fund holds a widely diversified portfolio and therefore does not have to

consider the risk impact of his decision to sell the specific stock. We further assume that stocks of this specific firm only yield a return of 0, when no intervention is undertaken, whereas the (opportunity) return of (re-)investing in the stock market is  $\Pi_S$ . A pension fund will sell as many stocks as possible, as long as the marginal return on the reinvestment exceeds transaction costs. Transaction costs consist of commissions, bid/ask spread, market impact, and opportunity costs. A commission is the charge paid to the broker (and eventually also to the stock exchange) and is usually the smallest part of the transaction costs (Grinold and Kahn). The costs for the bid/ask spread and the market impact (by how much the price is moved away from the price before the trade started) depend upon the liquidity of the stock and the size of the trade: The less liquid the stock and the bigger the trade are, the higher the market impact cost will be. The opportunity cost are the costs which would be incurred if the pension fund would not undertake the trade. Therefore, the pension fund could not reinvest the cash and the opportunity costs represent the foregone opportunity returns. Empirically, commission costs are easiest to measure. Berkowitz, Logue and Noser (1988) report average commission costs of 0.18% of principal value for stock trades at the NYSE. Due to competition and computerization, commission costs have been further reduced. Bikker, Spierdijk and van der Sluis (2007) analyze trades of the Dutch pension fund ABP and report commissions of only 0.12%. They also measure market impact costs for the trading activity of this big institutional investor and report impact costs of 0.2% for buys and 0.3% for sells. Although their market impact costs are higher than commission costs, these numbers must be viewed as a lower bound, since the analyzed trades are not motivated by the will to actively exploit economically relevant information concerning corporate governance, but only for the motive to rebalance the portfolio in a passive manner: Rebalancing trades, slight adjustments of portfolio weights by buying or selling smaller portion of stocks are undertaken when portfolio weights over time deviate from optimal ones. Trades of active institutional investors, which are

based on active information, i.e. that the stock price is over- or undervalued, have a much higher market impact on stock prices.

When other market participants, such as brokers, specialists or other blockholders recognize (by viewing the offered volume) that the fund wants to unload its position in a specific stock, they will suspect that the pension fund has superior information and so additional stocks will only be bought at progressively lower prices.<sup>16</sup>

We model therefore market impact costs  $m$ , ( $1 \leq m \leq 2 - k$ ) increasing steadily with trading size ( $s$ ).  $k$  represents commission costs and is set to 0.1%. The net proceeds of selling a portion of that specific stock then amount to

$$s\alpha_i(1 - k - (m^s - 1)) = s\alpha_i(2 - k - m^s) \quad (7)$$

Market impact is highest when a pension fund wants to unload all its stocks ( $s=1$ ) and the liquidity of the market is extremely low ( $m = 2 - k$ ). In this case, the stock price drops to zero. The pension fund will reinvest the net proceeds in the stock market. We assume that the pension fund will use the proceeds by investing proportionally in all the stocks of its portfolio in order to get the average return of the stock market,  $\Pi_S$ . This buy trade only incurs brokerage costs of  $k$  for the following two reasons: First, the buy tickets are smaller and second, the counterparty does not suspect an information asymmetry, since the volume of trades in this case is relatively small. It is now profitable for the pension fund to sell its shares of the “lemon” company and buy the market portfolio as long as the full trading costs, primarily the continuously rising market impact costs on the sale side are still lower than the expected gain of improving the portfolio. The return on the reinvestment,  $\Gamma$  is

$$\Gamma = \Pi_S(1 - k)s\alpha_i(2 - k - m^s) \quad (8)$$

It should be noted that this return on reinvestment represents ex ante, that is, before the pension

fund has taken its decisions, the opportunity costs of the other two options of either joining the coordinated effort or not doing anything and free-riding. By taking the derivative of  $\Pi_S$  with respect to  $s$  in equation (8), we derive the first order conditions for an optimal fraction  $s$ , to be sold by the pension fund

$$\Pi_S(1-k)\alpha_i(2-k-m^s) - \Pi_S(1-k)s^2\alpha_im^{s-1} = 0 \quad (9)$$

By solving equation (9) for  $s$ , we get  $s^*$ , the optimal fraction of stocks to be sold:

$$s^* = (2-k-m)^{1/2} \quad (10)$$

The lower the market impact  $m$ , the more it is profitable for the pension fund to use the exit strategy and sell the number of shares given by equation (10). The size of the market impact  $m$  will be determined by a number of factors: The higher  $\alpha_i$ , the fraction of the firm in possession of the pension fund, and the lower the so-called “free float” - the shares which are held by other non blockholding investors - the bigger will be the price drop when the pension fund starts to unload a part of its shares. Additionally, if small investors or other market participants can find out who the seller is and if the pension fund has a good performance record in the eyes of the investing public, the market impact will be bigger. Disclosure rules can force pension funds to declare their trading activities when they surpass certain thresholds, so that the regulatory environment can also impact how pension funds (and other large investors) act.

By the same rationality as described above we can derive the following equilibrium condition

from the perspective of an individual pension fund

$$\begin{aligned}
& \sum_{n=M}^N \frac{(N-1)!}{(n-1)!((N-1)-(n-1))!} P^{n-1} (1-P)^{(N-1)-(n-1)} \left[ \Pi_1 - \frac{C}{n} \right] \\
& = \\
& \sum_{n=M}^{N-1} \frac{(N-1)!}{n!(N-1-n)!} P^n (1-P)^{N-1-n} [(1-s)\Pi_1 + s\Pi_S]. \tag{11}
\end{aligned}$$

implying that

$$\frac{b(M|N, P)}{1 - B(M|N, P)} = s^* \left( \frac{\Pi_S - \Pi_1}{\Pi_1} \right) + \frac{C}{\Pi_1 M}. \tag{12}$$

For  $s^* = 0$  (no shares are sold, due to high transaction costs  $m$ ), Eq. (12) is equal to Eq. (5) without existence of an outside option. For  $s^* > 0$ , a closer inspection of Eqs. (11) reveals that the existence of an exit option increases the return from free-riding on the coalition's effort (see RHS). Moreover, the right-hand side of Eq. (12) is increasing in  $s^*$  and  $\Pi_S$ . Since the left-hand side is monotonically decreasing from one to zero, the existence of an outside option lowers  $P$  and  $Q$ .

The results are presented in Table 2(a), 2(b) and 2(c). We assume that the exit option offers a return of 5%, which corresponds to the long-term risk premium of equities. The market impact cost  $m$  depends in practice on the individual pension fund that sells shares. If it is expected that the selling pension fund is well informed, the market impact will be high. On the other hand, the market impact cost depend on the type of shares that are offered, i.e. the shares of small and relatively unknown firms will suffer from low liquidity and thus high market impact costs. We distinguish thus two cases with different market impact costs:  $m = 1.05$  and  $m = 1.25$ . Broker cost are set to  $k = 0.001$  which implies a fraction of sold shares of  $s^* = 0.8654$ , if  $m = 1.25$  and  $s^* = 0.9742$ , if  $m = 1,05$ . The results are presented in Table 2(a) and 2(b). Compared

to the baseline scenario (see Table 1(a)), the cost-benefit ratio in Table 2(a) has increased since pension funds can take advantage from the exit option, which lowers both  $P$  and  $Q$ . A lower market impact of stock selling (see Table 2(b)) increases the cost-benefit ratio again which further reduces the probabilities of coalition formation. In Table 2(c), we assume that the value of the firm drops by only 20%, if the coalition fails to form. Lower expected losses and the existence of the exit option drastically reduce the probability of coalition formation compared to Table 2(b) even further. In the case of low stock holdings per pension fund ( $\alpha_i = 0.1\%$ ) the probability of coalition formation is approximately zero.

## 5 Conclusions and discussion

Pension funds, like other institutional investors, have gained considerable weight in stock markets in the last decades and during the same time stock ownership especially of big public corporations has become more dispersed. In the absence of a market for corporate control and in light of the principal-agent problem this could lead to inefficient use of scarce capital not only at singular companies but also on the macro level. In this regard, the question arises if pension funds can enhance shareholder value by monitoring corporations and intervening in a coordinated manner if some firms are badly managed. In this paper it is assumed that the formation of a coalition of pension funds for monitoring purposes is costly, which induces the incentive to free ride. The higher the incentive to free ride, which is more likely to happen when ownership is more dispersed, the lower the probability of coalition formation. In this paper it has been shown, that

- (a) a less dispersed ownership among pension funds, i.e. each pension fund holds a higher portion of a singular firm, implies a lower number of pension funds necessary to form a coalition, which raises on the one hand incentives to free ride but leads on the other hand

to a higher cumulated probability of coalition formation, since coordination costs are lower.

- (b) the higher the portion of other market participants, institutional and private investors not participating in the vote, the smaller the minimum size of the coalition, which again increases the individual incentive of a pension fund to free ride, but again raises the cumulative probability of successful coordination, due to lower coordination costs.
- (c) lower coordination costs of forming a coalition improves directly the cost-benefit ratio, which strongly raises the probability of a successful coalition.
- (d) the more feasible the exit option - namely not rise the voice, but to sell the shares- the less pension funds will undertake a coordinated effort. The exit option is the more attractive, the more liquid capital markets are, which lowers transaction costs.

While the proportion of noise traders (b) and transaction costs (d) have a significant influence on the outcome if a successful coalition can form or not, both can not be regulated by the lawmaker. But directly and indirectly, different compulsory settings have a strong impact on the size of pension funds (a) and foremost on the height of coordination cost (d). The relaxation of the conditions under which shareholders could communicate during a proxy contest by the SEC in 1992 led to more monitoring and coordinated efforts by pension funds. Assessing the impact of these reforms Choi(2000) finds "some support to the argument that the legal barriers to shareholder communication should undergo further liberalization" (p. 266). In an analytic setting, this paper shows how strongly and through which channels, legal settings influence coordination costs and therefore the probability of success of coordinated action undertaken by pension funds in case of single firms.

Our research is also related to the research on corporate social responsibility in the context of pension funds as so called "universal owners", a label coined by Hawley and Williams (2000).



According to them “A universal owner is a large institution that holds in its portfolio a broad cross section of the economy, holds its shares for the long term, and does not trade except to maintain its index”. If pension funds adopt such goals and strategies, corporate governance can be understood as “the design of institutions that induce or force management to internalize the welfare of stakeholders” (Tirole, 2006, p.4). This line of argumentation relates to the fact that pension funds as financial intermediaries do have a long time horizon with regard to their liabilities, i.e. future pensions for their members and therefore should take into account intratemporal and intertemporal externalities when they decide whether or not to closely monitor firms. If that is achieved, pension funds would fully take on their role as “universal owners” . Hawley and Williams hypothesise that universal owners could assume the role of social planners, if some positive or negative external effects between profits of different firms exist. For example, if firm *A* hampers profits of firm *B* through the use of polluting technologies, it could be very well in the interest of pension funds for firm *A* to switch to a clean production technology, even if the value of firm *A* is lower after the switch. Monitoring activity in this regard would therefor also include an environmental dimension. From a corporate governance viewpoint, it is not clear if management of firm *A* should give in when approached by a pension fund asking to switch to a clean technology. By doing so it would impair the interest of shareholders, who held only stocks of firm *A* but none of *B*. Additionally, if these steps toward a cleaner technology could be undertaken continuously, management would face a dilemma: How should the conflicting goals of profit maximization and reduction of pollution be weighted? In this respect, it has to be noted, that Tirole (2001) mentions a clear lack of mission as one of three problems for the implementation of the stakeholder society.

## Footnotes

- 1 Incumbent management does not necessarily have to be incompetent or corrupt, but may simply be stubborn. As Jensen (1988) describes, “managers often have troubles abandoning strategies, they have spent years designing and implementing, even when these strategies no longer contribute to the organizations survival”, p.23.
- 2 According to Tirole (2001), institutional investors in the US mainly act as short-term stock market players, responsible for 80 percent of trading volume, with an average holding period of stocks of only 1.9 years. On the other hand, they are only rarely represented on the board.
- 3 See Pension Markets in Focus, OECD 2013, p.7 Table A1, p.35 and own calculations.
- 4 CalPERS for example alone manages USD 237 billion (June 30, 2012, [Quelle](#): Comprehensive Annual Financial Report) for more than 1.1 million active and inactive members and for more than 550 000 retirees and other beneficiaries. Pension Markets in Focus, OECD 2013, box 1, p. 17.
- 5 The operating efficiency of pension funds is measured by the ratio of total operating costs in relation to assets managed. Total operating costs include all cost of administration (handling of payments of active members and employers and paying benefits to retirees) as well as costs associated with asset management. In Canada administrative costs alone amount to about 0.4% of total assets. In the Netherlands total operating costs amount to 0.2%. Probably due to scale effects, the Netherlands enjoys such low costs: In the Netherlands pension fund assets are managed by only 393 pension funds (2011), whereas the number of pension funds in Switzerland is 1681 (2012) and in Canada 7870 pension funds (2012) fulfill this task. Even more widely dispersed are pension fund assets in the United Kingdom, where 65 523 pension funds existed in 2008. This is the last data point that OECD can

provide for the number of pension funds in the United Kingdom, and number of pension funds for the United States or Japan are not provided by OECD, probably due to data problems in the respective countries.

6 Solutions to overcome the free-rider problem have been proposed by Grossman and Hart (1980), Shleifer and Vishny (1986).

7 The term "institutional activism" subsumes (includes) "shareholder activism" (conflict between managers and shareholders) and "social activism" (potential conflict between portfolio or pension fund managers and investors or contributors).

8 This assumption is owed to the observation that even big pension funds like CalPERS hold only between 0.5 and 2 percent of a company (see discussion in the Introduction).

9 A detailed description of the algorithm and an example for a MatLab-solution routine is shown in the Appendix. Dixit and Olson (2000) yield numerical solutions through the inversion of the incomplete  $\beta$ -function. Our method minimizes numerical effort and is exact up to  $1 \cdot 10^{-9}$ .

10 We assume a linear cost function without further loss of generality. Convex cost functions would just alter the quantitative results.

11 Alternatively, we could assume that all the pension funds willing to form a coalition have to coordinate themselves on their own which would imply coordination costs of size  $\varepsilon \frac{M^2 - M}{2}$ . Hence, the endogenous probabilities of coalition formation we derive below are upward biased. The qualitative results of the model, however, remain unaffected.

12 Hermes manages about BP 26 billion assets for clients directly. Additionally, the Hermes Equity Ownership Service (EOS) serves 35 globally investing clients, pension funds and

other institutional investors, by offering intelligent voting for 10 000 companies worldwide. In order to pursue these monitoring activities Hermes employs around 30 specialists, of which many are Ex CEO, Corporate Governance experts or Investment bankers. The 35 clients of Hermes EOS are all big institutional investors, which together are responsible for the investment of BP 115 billion worldwide (source: <http://www.hermes.co.uk>).

13 Ethos was founded in 1997 by two pension funds from Geneva, Switzerland. Since monitoring was too costly and in order to gain more voting power, Ethos quickly opened up its services to other pension funds. The public pension fund of the City of Zurich was one of the first to join the Ethos coalition. Nowadays more than 140 pension funds and foundations have joined Ethos foundation, which owns the corporation Ethos Services AG. The main services of Ethos Services AG are proxy analysis and reports about Swiss companies together with voting recommendations and administrative support at the general assembly. The charge for the proxy analysis service for the 20 biggest Swiss companies, which usually are included in the Swiss Market Index (SMI), amounts to 0.001% of the assets the specific pension fund holds in Swiss equities (source: <http://www.ethosfund.ch/>).

14 In the last years, for example, the general assemblies of Novartis had very often controversial issues concerning remuneration of managers. Proxy advisors such as Ethos, International Shareholder Services (ISS) and others made recommendations. At the general assembly of 2012, the attendance rate was only 53% of total share capital (according to the website of Ethos). Of these 53% stockholders, not free-riding on the actions of other stockholders, assuming that the outcome would result in an economically efficient Novartis, the distribution was as follows: 8% came from shareholders present, proxy votes delegated to Novartis and represented by Novartis were 20% and stocks represented by independent proxy advisors such as Ethos were 72% (or 38% of all outstanding shares).

- 15 What is relevant for a successful formation of a coalition is the cumulative probability,  $Q$ , of drawing at least  $M$  IN's in  $N$  independent Bernoulli trials, which is determined by

$$Q = 1 - \sum_{n=0}^{M-1} \frac{N!}{n!(N-n)!} P^n (1-P)^{N-n}.$$

- 16 Since we only have one period of trading in our model, we assume that the pension fund appears only once at the market and discloses the amount of shares it wants to sell. A more detailed description of optimal trading and measuring of transaction costs is given in Grinold and Kahn (1999). In order to minimize market impact, large investors typically spread the trade over more periods while also having to consider opportunity costs.

## 6 Appendix

### 6.1 Hazard Rate

Suppose the random variable  $T$  has a continuous probability distribution  $f(t)$ , such that the cumulative probability distribution is

$$F(t) = \int_0^t f(s)ds = \text{Prob}(T \leq t). \quad (13)$$

The probability that the spell is of length at least  $t$  is given by the survival function

$$S(t) = 1 - F(t) = \text{Prob}(T \geq t). \quad (14)$$

The hazard rate answers the following question. Given that the spell has lasted until  $t$ , what is the probability that it will end in the next short time interval,  $\Delta t$ ? Hence

$$\lim_{\Delta t \rightarrow 0} = \frac{F(t + \Delta t) - F(t)}{\Delta t S(t)} = \frac{\frac{\partial F(t)}{\partial t}}{S(t)} = \frac{f(t)}{S(t)}. \quad (15)$$

→ The hazard rate is the rate at which spells are completed after duration  $t$ , given that they lasted until time  $t$ .

### Binomial Distribution

The probability of observing up to  $M$  successes in  $N$  independent Bernoulli-trials is given by

$$B = B(M|N, P) = \sum_{n=0}^M \binom{N}{n} P^n (1 - P)^{N-n}. \quad (16)$$

The probability of observing more than  $M$  successes in  $N$  independent Bernoulli-trials is given by

$$1 - B(M|N, P). \quad (17)$$

Hence, the hazard rate of the binomial distribution is given by

$$\lim_{\Delta P \rightarrow 0} = \frac{B(P + \Delta P) - B}{\Delta P(1 - B)} = \frac{\frac{\partial B}{\partial P}}{(1 - B)} = \frac{b}{B}. \quad (18)$$

→ The hazard rate of the binomial distribution answers the question, how big is the variation of the probability that there won't be more than  $M$  successes in  $N$  independent Benoulli-trials after an infinitesimal small increase in the probability of success in one trial,  $P$ , given that the probability of drawing more than  $M$  for fixed  $P$  and  $N$  is  $1 - B(M|N, P)$ .

## 6.2 Solution Algorithm

1. Define a vector  $i$  with  $nk$  elements, with  $nk$  not smaller than 100.
2. Span up a vector of probabilities  $P = \{P_{\{i=1\}} = 0, \dots, P_{\{i=nk\}} = 1\}$ .
3. Calculate  $x_{\{i\}} = 1 - \frac{b_{\{i\}}}{\sum_{n=0}^M \frac{N!}{n!(N-n)!} P_{\{i\}}^n (1-P_{\{i\}})^{N-n}}$ .
4.  $1 - \frac{b}{\sum_{n=0}^M \frac{N!}{n!(N-n)!} P^n (1-P)^{N-n}}$  is declining in  $P$ . Find that  $P_{\{i\}}$  for which  $x_{\{i\}} < \frac{C}{VM}$  and set  $i = \max$  and  $i - 1 = \min$ .
5. Define a new vector with  $\frac{P_{\{max\}} - P_{\{min\}}}{nk-1}$  entries from  $P_{\{min, i=1\}}$  to  $P_{\{max, i=nk\}}$ .
6. Go back to Step 3 until  $\frac{C}{VM} - x_{\{max\}} < tol$ , with  $tol = 1 \cdot 10^{-j}$  and  $j \geq 9$ .

## 6.3 MatLab- solution routine

```

06.04.06 14:14 C:\Programme\MATLAB704\work\dixitolsonnum.m 1 of 1

function dixitolsonnum
clc

N=30;
M=10;
nk=200
tol=0.00000001;
P=0:1/nk:1;

%C = (1-binopdf(M,N,0.048)/(binocdf(M,N,0.048)));
C=9.99/M;

i=1;

while i<nk+1
    x=1-factorial(N)/(factorial(M)*factorial(N-M))*P(i)^M*(1-P(i))^(N-M)/(binocdf(M,N,P(i)))
    %x = 1 - binopdf(M,N,P(i))/(binocdf(M,N,P(i)))
    if (x<=C)
        P(i)
        max=i
        i=nk+1
    else
        i=i+1
    end
end

x
di=C-x

while di>tol

Pu=P(max-1)
Po=P(max)
step = (Po-Pu)/(nk-1)

P=Pu:step:Po;

i=1;

while i<nk+1
    x=1-factorial(N)/(factorial(M)*factorial(N-M))*P(i)^M*(1-P(i))^(N-M)/(binocdf(M,N,P(i)))
    %x = 1 - binopdf(M,N,P(i))/(binocdf(M,N,P(i)))
    if (x<=C)
        max=i;
        i=nk+1;
    else
        i=i+1;
    end
end

P(max)
x
di=C-x
end

```



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$\alpha_i$	$M$	$\frac{C}{\Pi_1 M}$	$P$	$Q$
(a) Baseline scenario				
$N = 200; O = 0.001; \varepsilon = 0.00004; \alpha_{crit} = 0.1$				
0.002	50	0.03	0.2915	0.9164
0.0015	67	0.0366	0.3727	0.8805
0.001	100	0.05	0.5286	0.8113
(b) $\alpha_{crit} = 0.15$				
0.002	75	0.0267	0.4207	0.9170
0.0015	100	0.0333	0.5401	0.8865
0.001	150	0.0467	0.7792	0.8600
(c) Higher coordination costs: $\varepsilon = 0.0004$				
0.002	50	0.21	0.2243	0.2137
0.0015	67	0.27	0.2797	0.0499
0.001	100	0.41	0.3796	0
(d) Lower benefits: $\frac{C}{0.2\Pi_1 M}$				
0.002	50	0.15	0.2416	0.4172
0.0015	67	0.1831	0.3101	0.2447
0.001	100	0.25	0.4433	0.0619

Table 1: Endogenous probability  $P$  for choosing to join the coalition and the cumulative probability,  $Q$ , that at least  $M$  pension funds form a coalition.

**Exit option (reference scenario see Table 1(a)):**  $\Pi_S = 1.05; k = 0.001$

$\alpha_i$	$M$	$s^* \left( \frac{\Pi_S - \Pi_1}{\Pi_1} \right) + \frac{C}{\Pi_1 M}$	$P$	$Q$
(a) $m = 1.25$ which implies $s^* = 0.8654$				
0.002	50	0.0733	0.2684	0.7452
0.0015	67	0.0799	0.3490	0.6853
0.001	100	0.0933	0.5060	0.5954
(b) $m = 1.05$ which implies $s^* = 0.9742$				
0.002	50	0.0787	0.2661	0.7218
0.0015	67	0.0853	0.3465	0.6593
0.001	100	0.0987	0.5036	0.5680
(c) like (b), i.e. $m = 1.05$ and $s^* = 0.9742$ , but lower losses: $\frac{C}{0.2\Pi_1 M}$				
0.002	50	0.1987	0.2274	0.2463
0.0015	67	0.2318	0.2914	0.1171
0.001	100	0.2987	0.4246	0.0189

Table 2: Exit option with different market impact  $m$ .

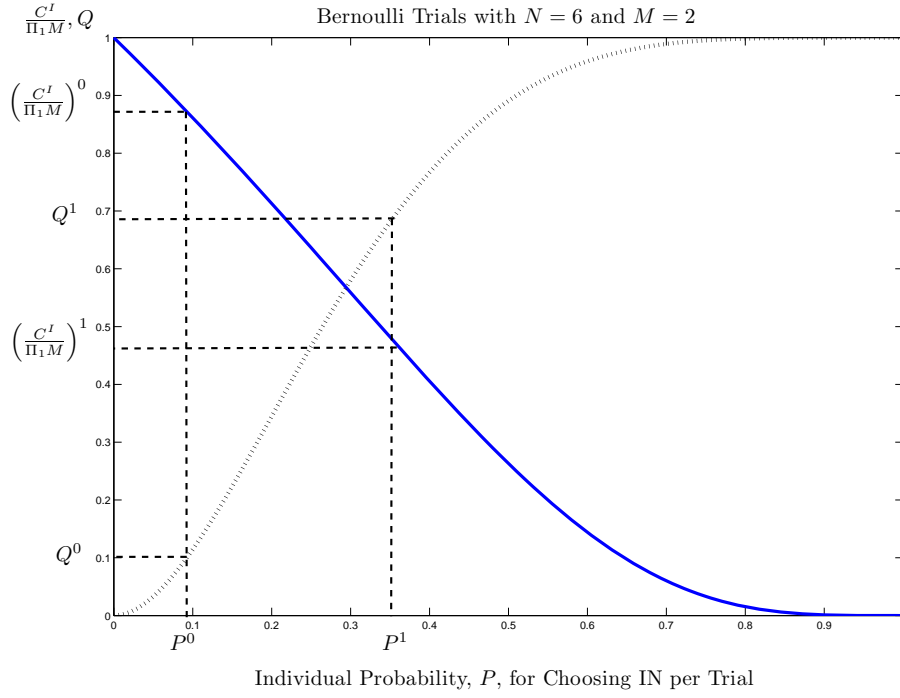


Figure 1: Determination of the endogenous probability,  $P$  (see Eq.(5)). Solid line: hazard rate of  $M$  successes as a function of  $P$  for given  $N$ . Dashed line: Cumulative probability,  $Q$ , that a coalition of size  $M$  will form as a function of  $P$  for given  $N$ .

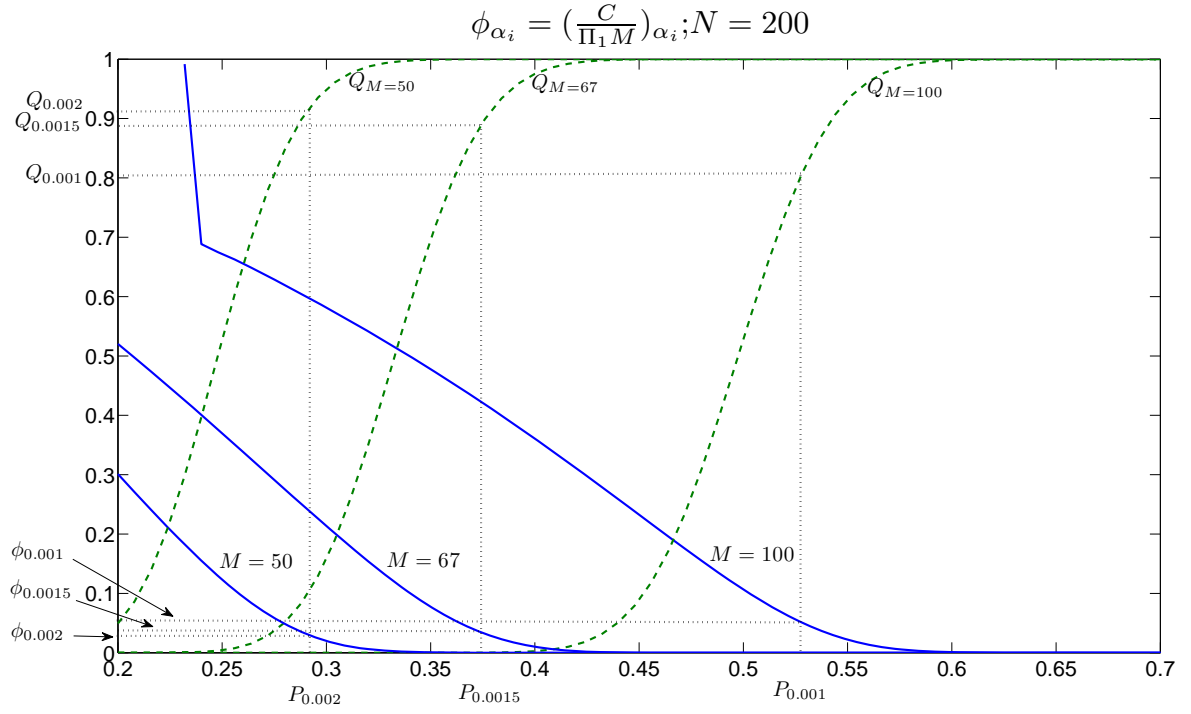


Figure 2: Graphical presentation of the Baseline Scenario (see Table 1(a)).

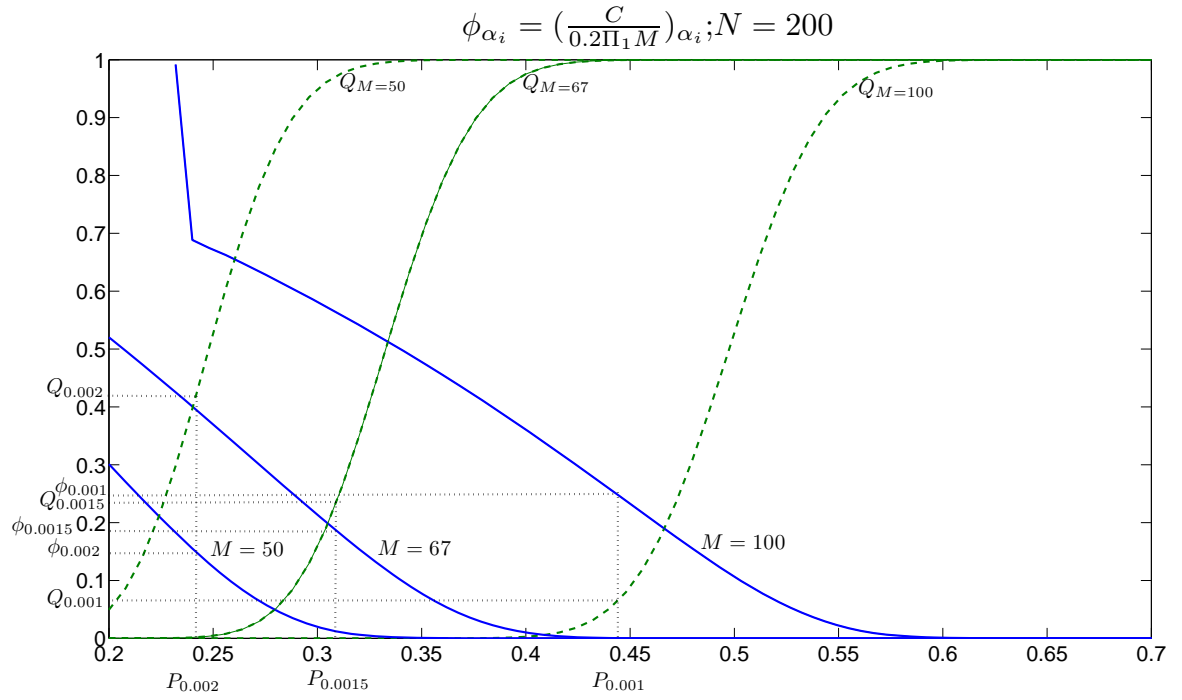


Figure 3: Graphical presentation of the effects of a reduction in expected losses if the coalition fails to form (see Table 1(d)).